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WORKSHOPS — MONDAY 16 OCTOBER 2006, 16:00–17:30

Workshop 1

MR urography: oncological applications

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Magnetic resonance (MR) urography has an expanding role as a problem solving tool in treated cancer. Hydronephrosis is common with abdominopelvic neoplasms and whilst the majority are satisfactorily investigated by urography, ultrasound (US), computed tomography (CT), invasive imaging or endourological techniques, some hydronephroses remain unexplained. These may occur in patients with renal impairment, contrast allergy, poor performance status or who pose problems with instrumentation or cannulation of the urinary tract. A simple, rapid and effective technique combines overview heavily T2-weighted images of the urinary tract, e.g. single shot fast spin echo (SSFSE) which allow identification of the point of obstruction followed by high resolution T2-weighted images in two orthogonal planes through this region of interest. The study requires no patient preparation as it relies upon intrinsic contrast between obstructed urine and soft tissues. A duration of 20 min or less is well tolerated by even sick patients. MR urography has a more limited role in the diagnosis of primary tumours of the urothelium but again may be useful when contrast or CT urography is contraindicated or non-diagnostic. T2-weighted techniques are able to identify obstructing or structuring lesions. There are more limited data for the use of MR urography to diagnose small urothelial tumours in the upper tracts but it appears that even contrast enhanced MR excretory urography lacks the detail of traditional X-ray urography. Finally, MR urography may be applied as a rapid non-invasive method of investigation of urinary incontinence or suspected fistulation in the treated cancer patient.

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Renal cell carcinoma: detection, staging and surveillance

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Small incidental renal cell carcinomas have been diagnosed with increasing frequency in the last two decades due to the widespread use of cross sectional imaging techniques for various indications. These tumors usually are low stage and low grade tumors with much improved survival rates as compared to symptomatic tumors. The TNM staging of renal cell carcinoma and the impact of new classification for T staging on survival is discussed. CT is the most commonly used modality in the detection, characterization and staging of renal cell carcinoma. The various multidetector CT techniques used in renal mass detection and characterization and their pitfalls are discussed. The role of MRI and PET in staging is also addressed. Although radical nephrectomy has been the gold standard used in the treatment of renal cell carcinomas, more recently the renal preservation technique of partial nephrectomy (either open or laparoscopic) has emerged as the leading technique that is being used worldwide for organ-confined tumors. In poor-risk surgical patients, ablation techniques are also being used, with excellent results being reported in early trials. The European Urological Association has set up standards for surveillance of patients with prior nephrectomy for renal cell carcinoma, which advocates clinical evaluation and chest X-rays, with abdominal CT being used optionally. While no standard surveillance methodology has been adopted in the United States, different institutions have established their individual follow up strategies, with most advocating the more liberal use of abdominal CT.

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MR lymphography of the pelvis: how to do it

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The detection of metastatic nodal disease is important for patient management and nodal involvement is of prognostic importance for virtually all pelvic tumours. Pelvic lymph node dissection followed by histological evaluation is the current 'gold standard' for determining the presence of cancer in pelvic lymph nodes; this method is invasive and has several shortcomings including limited sampling area, post-surgical morbidity and complications, and high inaccuracy for frozen section analysis. Nodal size assessment on imaging is known to be a limited method of assessment. A new class of magnetic resonance (MR) contrast agents for MR lymphography is expected to be licensed in Europe within a year based on ultra small super-paramagnetic oxide particles (USPIOs), known generically as ferumoxtran-10 (Sinerem, Laboratoire Guerbet, Aulnay sous Bois, France or Combidex, Advanced Magnetics, Cambridge, MA, USA). MR lymphography has emerged as the most promising new technique that is able to overcome current imaging limitations with meta-analyses confirming its diagnostic superiority. Its higher diagnostic precision is based on improved functional and anatomical definition based on macrophage functionality. In anticipation of imminent licensing, this workshop focuses on factors for optimizing image acquisition including drug dosage and administration, the timing of post contrast imaging, imaging planes, and parameters for T2*-weighted sequences. The commonest sites for nodal metastases from different pelvic cancers are considered as well as the criteria to be used for nodal determinations. Artefacts and pitfalls that may hamper image interpretation are also discussed. The anticipated diagnostic accuracy that could be achieved based on multireader assessments and factors that may alter the learning curve are discussed.

Workshop 2

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Sentinel node biopsy

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The prognosis of breast cancer is determined primarily by axillary lymph node status. Sentinel lymph node biopsy (SNLB) is a minimally invasive alternative to axillary lymph node dissection (ALND) for nodal staging in breast cancer. The technique assumes orderly progression of tumour spread to the regional nodes; biopsy of the first node in the lymphatic chain at risk for metastasis should therefore reflect involvement of the remaining nodes. Excellent clinical outcomes have been achieved in over 20 000 patients studied to date and comparison of the results of SNLB with ALND have shown that the sentinel node is representative of the presence or absence of metastases in the remainder of the nodal basin with a false negative rate of less than 2% in many series. This lecture discusses ongoing controversies such as the role of preoperative lymphoscintigraphy, the site and timing of injection and factors influencing the false negative rate. Relevant clinical issues such as its role in multifocal breast cancer, ductal carcinoma-in-situ, large (>4 cm) tumours and extraaxillary nodal sites are also discussed.

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FDG-PET/CT in the diagnosis and management of breast cancer

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Fluorodeoxyglucose (FDG)-positron emission tomography (PET) is establishing a role in the management of breast cancer. It can be used in staging the original disease and identifying recurrent disease and distant metastases, to plan radiotherapy fields and assess response to chemotherapy. FDG-PET can be used in the diagnosis of the primary tumour and the extent of local disease, but cannot be used in differentiating the aetiology of mammographic microcalcification. The size of the tumour is important with reported sensitivity for tumours <2 cm of 64%, rising to 91% in tumours >2 cm. A recent study comparing magnetic resonance imaging (MRI) and FDG-PET found a comparable diagnostic accuracy (84% vs. 88%), the sensitivity for FDG-PET was less (79% vs. 100% for MRI) but the specificity for FDG-PET was better (94% vs. 72%). The false negative rate is higher for invasive lobular carcinoma compared to invasive ductal carcinoma (65.5% vs. 23.7%). FDG-PET is useful in identifying multifocal tumours (sensitivity 63% and specificity 95%). Axillary nodal staging is the most important prognostic factor in breast cancer. Clinical examination is poor and patients therefore undergo nodal sampling, however 70% of T1 and T2 tumours will be node negative. FDG-PET depends on activity not size of nodes and the reported sensitivity for axillary nodal disease ranges from 61% to 95% with a specificity of 80%–96% and overall accuracy of 77%–89%. FDG-PET has limited spatial resolution (5–7 mm) and misses small nodes or micrometastases. This may be a particular problem with small primary tumours where the sensitivity for axillary nodal disease may drop to 33%. FDG-PET will not replace sentinel node biopsy in clinically node negative patients but may avoid sentinel node biopsy in those patients with large tumours and positive nodes on FDG-PET where total nodal clearance is more appropriate. FDG-PET cannot replace axillary clearance, but in patients with locally advanced disease, who will be treated with primary chemotherapy, it will demonstrate the extent of the nodal disease. FDG-PET appears to be better than CT in defining thoracic nodal involvement. CT had a reported sensitivity of 54% (FDG-PET 85%) and specificity of 85% (FDG-PET 90%) with an overall diagnostic accuracy of FDG-PET of 88% and CT 73%. The role of FDG-PET in bone metastases is more contentious. Some studies have shown FDG-PET to be equal or superior to isotope bone scans; other studies have found FDG-PET to be superior mainly because of superior delineation of osteolytic metastases. FDG-PET is a whole body imaging system and has proven superiority over other techniques for distant metastases. It is a useful tool for identifying recurrent disease, both involvement of the brachial plexus and nodal recurrence. FDG-PET can be used in the assessment of response to chemotherapy by measuring the changes in standardised uptake values (SUV) during therapy. Scans performed mid therapy on patients who are responders will show a decrease in SUV by more than 50%, whereas the non-responders show a more modest decline. The use of FDG-PET to predict survival has not yet been established. FDG-PET performed early in treatment (after one course of chemotherapy) does appear to be able to predict which patients will be responders and potentially allow alteration of drug regimes. However, patients on hormone treatment may show a transient increase in metabolic activity or 'flare response' within the first 2 weeks of treatment. Studies at the end of therapy show that a positive scan indicates residual disease but a negative scan does not exclude disease, particularly in the axillary nodes. Combining data with MRI may prove to be beneficial.

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MRI breast for staging and follow up

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The content of this workshop is covered by the article entitled "Screening women at increased risk with MRI" on page S21.

Workshop 3

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Liver metastases: imaging considerations for protocol development with multislice CT (MSCT)

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Conventional, single-slice helical computed tomography (SSCT) allowed for scanning the majority of the liver during the critical portal venous phase. This was often referred to as the 'optimal temporal window'. The introduction of current day multislice CT (MSCT) now allows us to acquire images in a much shorter time and more precisely than ever before. This yields increased conspicuity between low attenuation lesions and the enhanced normal liver parenchyma and optimal imaging for the vast majority of hepatic hypovascular metastases. Most importantly, these scanners, when compared to conventional non-helical scanners, avoid impinging upon the 'equilibrium' phase when tumors can become isodense/invisible. MSCT also allows for true multiphase scanning during the arterial and late arterial phases for detection of hypervascular metastases. The MSCT imaging speed has increased significantly over the past years with the introduction of 32- and 64-detector systems and will continue to increase in the future volumetric CT. This provides a number of important gains that are discussed in detail.

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Imaging for liver metastases—MRI

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Magnetic resonance (MR) imaging is the imaging modality of choice for detection and characterization of focal liver lesions including liver metastases. Pre-operative detection and localization of liver metastases is of critical importance. In this respect, recent advances in MR imaging and availability of newer MR contrast agents have improved its ability to detect and localize liver metastases. MR imaging is also useful to assess treatment response following surgical resection, chemoembolisation, radiofrequency ablation or alcohol ablation of liver metastases. In this presentation, MR imaging protocols and use of gadolinium, iron and manganese based MR contrast agents for evaluation of suspected or known liver metastases are discussed. In addition, the role of MR imaging in detection, localisation and characterisation and post-treatment follow-up of liver metastases are discussed. Typical and atypical MR features and enhancement patterns are also illustrated.

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Fat and the liver

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In spite of its central role in fat metabolism, the liver normally contains no more than 5% fat; with greater amounts the condition is described as fatty liver or hepatic steatosis. Although fatty liver is usually asymptomatic, it can be a manifestation of a serious underlying problem, e.g. alcoholism, diabetes mellitus, or drug toxicity. It may also be a precursor to cirrhosis. Fat in the liver also has major implications for imaging. The fat may mimic other more serious liver diseases, the presence of fat may conceal or disguise disease, and some liver tumours can be characterised by their fat content. Increased echogenicity on sonography or decreased attenuation on computed tomography (CT) can both show severe fatty change, but signal loss on opposed-phase T1-weighted magnetic resonance imaging (MRI) is the most sensitive indicator of either diffuse or focal fatty change, focal sparing in a diffuse fatty liver, and focal liver lesions which may be obscured on ultrasound and CT by diffuse fatty change. Some hepatocellular carcinomas contain enough fat to demonstrate on chemical shift MRI whilst regenerative and dysplastic nodules in cirrhosis very rarely contain sufficient fat to be recognised on imaging. The fat content of focal nodular hyperplasia is usually insufficient to be detected; hepatocellular adenoma often shows fat content on imaging. Other tumours with a substantial fat component include lipoma, angiomyolipoma, liposarcoma, and gall bladder carcinoma; fat in metastatic liver tumours has been described only in relation to liposarcoma and rare cases of renal cell and neurendocrine tumours.